EXECUTIVE SUMMARY

This Preliminary Economic Assessment analyzes the potential impact of new performance requirements and test procedures for advanced air bag systems as proposed in the accompanying SNPRM. Consistent with the National Highway Traffic Safety Administration Reauthorization Act of 1998, which is part of Public Law 105-178, the intent of this rulemaking is to minimize risks caused by air bags to out-of-position occupants, especially infants and children, and to improve occupant protection provided by air bags for belted and unbelted occupants of all ages. To achieve these goals, NHTSA is proposing to establish test procedures that broaden the scope of the current standard to ensure that occupants are properly protected under a wider variety of crash circumstances.

Test Proposals

The risk of injury from air bags arises when occupants are too close to the air bag when it inflates. Generally, those most at risk from injury are infants, young children, and out-of-position drivers. To address these concerns, new tests are proposed which employ crash dummies representing infants, 3-year olds, 6-year olds, and 5th percentile female drivers. A variety of tests are proposed to protect these at-risk occupants. These tests generally require either that the air bag be suppressed if certain risk conditions exist or that deployments occur at levels that produce a low probability of injury risk.

The agency is also proposing two alternative sets of high speed tests to preserve and enhance air bag protection. The tests include: frontal rigid barrier tests, 30 degree oblique tests into a rigid barrier, or 40 percent offset frontal deformable barrier tests. Tests may be performed at a variety of speeds under belted or unbelted conditions using 5th percentile female or 50th percentile male crash dummies. The primary difference between the two alternatives is their treatment of unbelted occupants. Alternative 1 would require an unbelted 29 to 48 kmph (18 to 30 mph) frontal rigid barrier test, while Alternative 2 would require an unbelted 35 to 56 kmph (22 to 35 mph) offset deformable barrier test. Chapter I provides the detail of the two alternative sets of high speed tests.

Under consideration for Alternative 1 is an unbelted 29 to 40 kmph (18 to 25 mph) test for a temporary time that would increase at a later date to a permanent 29 to 48 kmph (18 to 30 mph) test. Also, under consideration is an unbelted 29 to 40 kmph (18 to 25 mph) frontal rigid barrier test coupled with an increase in the belted test from the current up to 48 kmph (30 mph) to an up to 56 kmph (35 mph) test. The belted up to 56 kmph (35 mph) test may have a later effective date than the effective date of the unbelted 29 to 40 kmph (18 to 25 mph) test.

NHTSA is also proposing to upgrade the injury criteria by changing the way head injuries are measured, by including a measure of neck injury, and by reducing the allowable chest deflection during the tests.

Technical Feasibility

The agency has tested three vehicles to most of the proposed tests. These are the Dodge Intrepid, the Toyota Tacoma, and the Saturn SL1. The Saturn passed all of the proposed Alternative 1 high speed tests and the out-of-position tests on the driver side. It did not meet the proposed out-of-position tests on the passenger side. However, with the addition of a weight sensor, the agency believes the 1999 Saturn could pass the proposed Alternative 1 tests. The Saturn also did not pass the 56 kmph (35 mph) offset deformable barrier test with the 5^{th} percentile driver-side dummy. Thus, it could not currently pass the Alternative 2 set of tests. However, the margin of failure was small and the agency believes it could pass with more design effort, additional structure, and/or additional technology. The Saturn performed better in these tests overall than the Intrepid or Tacoma. It has a different air bag design than most vehicles in its tether design in the center of the air bag. Overall, the agency believes that with different designs, more advanced sensors, and multi-stage inflators, manufacturers will be able to produce vehicles that pass the proposed test requirements.

Benefits

The assessment provides analyses of the safety benefits from tests that reduce the risk of injury from air bags in low-speed crashes, as well as from tests that improve the overall effectiveness of air bags in high speed crashes. For out-of-position occupants that are at risk of being injured by air bags, the agency estimates that out of 45 at-risk drivers that would have been killed with pre-MY 1998 air bags, 21 to 39 would be saved with low-risk air bags for the driver side. The agency also estimates that out of 136 passengers that would be have killed with pre-MY 1998 air bags, 91 would be saved with weight sensors and 122 to 134 would be saved with low-risk air bags. Of an estimated 37 drivers that would have an MAIS 3-5 injury, 20 to 33 could be prevented by low-risk deployment air bags. Of an estimated 218 passengers that would receive MAIS 3-5 injuries, about 149 could be prevented by a weight sensor and 168 to 212 could be prevented with a low-risk deployment air bag.

Chapter VI also contains estimates of the benefits of incremental improvements in safety compared to a baseline of pre-MY 1998 air bag vehicles for each compliance scenario. Tables VI-31 to VI-36 provide summary benefit estimates for meeting specific proposed tests and combinations of tests. These are calculated by taking the available test data (based on vehicles designed to the 48 kmph (30 mph) belted and unbelted tests) and determining the benefits of bringing those test scores that are above the proposed injury criteria performance levels down to the level of the proposal in this SNPRM. This methodology assumes that manufacturers would make as few changes as possible to their fleet to meet the new proposals. Thus, it does not assume that manufacturers might completely redesign their air bag fleet if the final rule had a high speed test other than the 48 kmph (30 mph) rigid barrier test. This analysis found that improved safety from vehicles passing the high speed Alternative 1 proposals would save 70 to 226[1] lives and prevent 342 to 701 MAIS 2-5 injuries. Combining the at-risk benefits and the high speed Alternative 1 results in a range of benefits of 161 to 226 lives saved and 491 to 701 non-fatal MAIS 2-5 injuries prevented.

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[1] Estimated benefits from at-risk groups and high speed tests cannot be added to get a total, since there is an overlap in benefits.

A similar analysis was prepared for Alternative 2, however, there are such limited data available that the impact is uncertain. To the best of our knowledge, no vehicles have been designed to a 35 to 56 kmph (22-35 mph) offset deformable barrier test. Without vehicles to test, a direct estimate of the difference in safety benefits for Alternative 2 is highly uncertain. The analysis for Alternative 2 uses test results from vehicles designed to meet a 30 mph unbelted rigid barrier test. It is questionable whether this gives appropriate results for the future benefits of such a test.

Another set of analyses compares the data available on redesigned MY 1998/99 air bags compared to pre-MY 1998 air bags to examine how well the redesigned bags are doing compared to their predecessors. Based on the limited data available for analysis, redesigned MY 1998/99 air bags appear to have reduced the fatality rate to out-of-position occupants in low-speed crashes (less than 25 mph delta V) to about 30 percent of the fatality rate of pre-MY 1998 air bags. However, limited real-world data indicate no statistically significant difference in <u>overall</u> fatality rates between the pre-MY 1998 and MY 1998/99 air bags. Most test data between matched pairs of air bag vehicles show no difference for belted occupants and small differences for unbelted occupants when comparing the pre-MY 1998 and MY 1998/99 air bags.

The agency also estimated the benefits of an unbelted 29 to 40 kmph (18 to 25 mph) frontal rigid barrier test coupled with an increase in the belted test from the current up to 48 kmph (30 mph) test to an up to 56 kmph (35 mph) test. Assuming <u>all</u> vehicles air bags were designed to <u>only</u> meet the unbelted 25 mph rigid barrier and oblique tests, an estimated 214 to 397 lives saved by pre-MY 1998 air bags would not be saved. Assuming minor changes to the seat belt and air bag systems of these vehicles to meet the 56 kmph (35 mph) belted test, it is estimated that 6 to 13 belted occupant s lives could be saved by increasing the belted test speed to 56 kmph (35 mph). Overall, 201 to 391 lives saved by pre-MY 1998 air bags might not be saved by the 48 kmph (25 mph) unbelted/56 kmph (35 mph) belted option.

Sensitivity analyses are provided on increases in safety belt use and the impact of using the MY 1998/99 air bags as a baseline for determining benefits.

Sled Tests

Sled tests were temporarily allowed as an alternative method to certify compliance with FMVSS 208 in March 1997 in order to facilitate introduction of redesigned air bags. A provision of the NHTSA Reauthorization Act (P.L. 105-178) provided that this method would remain in effect until changed by the final rule. NHTSA is proposing to eliminate the sled test alternative because it is not representative of real world crashes that have the potential for serious injury or fatality, and it does not adequately test how well the vehicle and its restraint system protect outboard front seat occupants in those situations. Relatively modest changes have occurred thus far in air bag designs that use the sled test for compliance. However, NHTSA is concerned that potentially, air bag systems designed only to pass the sled test would expose occupants in higher speed crashes to significant increases in crash forces and the potential for serious or fatal injuries. For example, because the sled test is only a 12 o clock test, there is concern that it could lead to decreased air bag volume, which would provide less protection in frontal crashes at offset angles and to unbelted passengers in any frontal high speed crash. NHTSA examined air bag data supplied by nine auto manufacturers in response to an information request issued by the agency in December 1997. The agency found that of 42 passenger side model year 1998 systems examined, 10 had decreased air bag volume. Eight of these ten decreased the width of the air bag. This demonstrates that air bags designed to meet the sled test may provide protection to a smaller area of the occupant compartment, or in a narrower set of collision angles.

NHTSA performed several analyses to estimate the impact of using the sled test in place of the 30 mph barrier test. One analytical approach assumed the possibility that air bags designed to the frontal sled test would provide benefits in full frontal impacts (12 o clock strikes), but might provide no benefit in partial frontal impacts (10, 11, 1, and 2 o clock strikes). This analysis estimates that if all passenger and driver side air bags were changed to only provide benefits in pure frontals, the only test mode in the sled test, there could be as many as 245 lives that would not be saved by air bags every year for unbelted occupants.

While the generic sled test has been part of FMVSS 208 since MY 1998, these vehicles were not designed from the start with only the generic sled test as the unbelted test, but were redesigned from vehicles originally designed to meet the pre-MY 1998 standards which included a 48 kmph (30 mph) unbelted rigid barrier test. Another set of analyses attempts to provide estimates of the potential loss in benefits if all vehicles were designed to the minimum performance of the generic sled test instead of a full vehicle barrier test in terms of impact severity and speed. The agency estimates that the generic sled test is equivalent to a barrier test of 22 to 25 mph in velocity. The range of estimates are that 214 to 722 fewer fatalities could be prevented if all vehicles were designed to the minimum requirements of a sled test.

Costs

Potential compliance costs for this proposal vary considerably and are dependent upon the method chosen by manufacturers to comply. Methods such as modified fold patterns and inflator adjustments can be accomplished for little or no cost. More sophisticated solutions such as proximity sensors can increase costs significantly. The range of potential costs for the compliance scenarios examined in this analysis is $20-$127 per vehicle (1997 dollars). This amounts to a total potential annual cost of up to $2 billion, based on 15.5 million vehicle sales per year.

Property Damage Savings

Compliance methods that involve the use of suppression technology have the potential to produce significant property damage cost savings because they prevent air bags from deploying unnecessarily. This saves repair costs to replace the passenger side air bag, and frequently to replace windshields damaged by the air bag deployment. Property damage savings from these requirements could total up to $85 over the lifetime of an average vehicle. This amounts to a potential cost savings of nearly $1.3 billion.

Compliance Scenarios

This assessment identifies and analyzes four groups of possible compliance scenarios that combine the two alternative high speed test groups with optional test procedures for the at-risk (out-of-position) groups. One scenario (Option #1) assumes that out-of-position infant and children requirements will be met with the automatic suppression test, while driver requirements will be met with the low risk deployment test. A second scenario (Option #2) assumes that infant requirements will be met with the automatic suppression test, and that children and driver requirements will be met with the low risk deployment test.

Net Cost Per Fatality Prevented

Based on the analysis which assumes manufacturers would make the minimal amount of changes necessary to meet the proposals, net costs per equivalent fatality prevented estimates were made. Property damage savings have the potential to offset all, or nearly all of the cost of meeting this proposal. The maximum range of cost per equivalent fatality saved from the scenarios examined in this analysis is a net savings of $1.3 million per equivalent fatality saved to a net cost of $2.7 million per equivalent fatality saved. The range for passenger-side impacts is more favorable than for driver-side impacts. This is due to the potential property damage savings from suppressing air bags for children, and because there are far fewer out-of-position drivers at risk than there are passengers, particularly children. Passenger side costs vary from a net savings of $3.8 million per equivalent fatality to a cost of $2.1 million per equivalent fatality. On the driver's side, costs range from zero to a cost of $4 million per equivalent fatality prevented.